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Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

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Empfohlene Zitierung / Suggested Citation:

Petschick, G. (2015). Ethnographic panels for analyzing innovation processes. *Historical Social Research*, 40(3), 210-232. <https://doi.org/10.12759/hsr.40.2015.3.210-232>

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Ethnographic Panels for Analyzing Innovation Processes

Grit Petschick*

Abstract: »Ethnographische Panels zur Analyse von Innovationsprozessen«. Many innovations occur over long periods of time as complicated and dynamic processes. Ethnographies, which accompany innovation processes in real time, enable to focus on the process-accompanying aspects, like ruptures and change events, of such innovations. Though, such ethnographies require a great deal of (time) investment, and in most cases, an interpretation of such a process as an innovation is only possible at the end of this process, i.e., ex-post. Ex-post conducted studies, like qualitative interview studies, are not confronted with this problem. But, at the same time, they lack the situational detailed knowledge of the field to make statements about the innovation proceeding. Hence, for process accompanying investigations of innovations, I propose the methods of ethnographic panel: a mixed methods approach of multiple short-term field visits, during which, apart from participant observations, the ethnographer focuses particularly on qualitative interviews and conversations. In this paper, this approach will be described and afterwards illustrated by an example. Therefore, I draw on the concept of structural innovation.

Keywords: Methods, innovation, ethnography, qualitative interviews, mixed methods, structural innovation, innovation research, systems theory.

1. Introduction

As “creative practices and innovative processes have become a ubiquitous phenomenon across all areas of society” (Hutter et al. 2015, 33, in this HSR Special Issue), innovation is a much researched field. Its processes are distinguished based on various aspects such as: period of time, sectors and fields involved, type of innovation, historical period, and country (e.g., Rammert 2010; Pavitt 2013 [2005], 87). Therefore, in the context of innovation research, there are many studies on innovations as well as approaches to and concepts for defining them. Innovations are often described as complex, protracted, and dynamic processes that can only be defined ex-post as innovations (Pavitt 2013

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[2005]); Beckenbach 2010, 56f; Bormann et al. 2011, 14f; Besio and Schmidt 2012). Thus, innovation research faces a particular challenge regarding its methods. At the same time, there is a discrepancy between the knowledge about innovation and the methods for its observation: The research on innovation outweighs its methods.

The range of methodical approaches provided in the literature for researching innovation is just as broad as the innovative phenomena being investigated. Herein the specific strengths and limitations of quantitative and qualitative methods become apparent. Quantitative data can show the diversity of innovative phenomena as well as the conditions that might cause them (Siebenhüner 2010, 108). Due to the large sample size, outcomes based on quantitative data can be generalized, hypotheses can be tested, and correlative relationships between variables can be identified (*ibid.*, 108). In contrast, qualitative studies allow the course of innovative processes to be studied in its full complexity with all its ruptures, like chance events, controversies, and dead ends (*ibid.*, 107; Hoholm and Araujo 2011). As in other areas of research, a mixed methods approach enables researchers to take advantage of the benefits of both methodological threads (Baur 2012). Thus, mixed method approaches are more and more used in innovation research (e.g., Siebenhüner 2010; Schubert and Windeler 2010).¹ The present paper agrees that there are benefits from mixed methods and proposes a specific ethnographic point of entry for innovation research.

Ethnography (including Emerson 1987; Hammersley and Atkinson 1995; Fetterman 2010) is considered a pluralistic method that uses participant observation (Thierbach and Petschick 2014) as its primary method (e.g., Fetterman 1997). Depending on the object and question of research, additional quantitative and qualitative methods are also used for data collection. Ethnography is particularly applicable to research that addresses questions of innovation dynamics and mechanisms as complex processes. Innovations can also be concomitantly investigated, i.e., “in-the-making,” by focusing on interactions and practices (Hoholm and Araujo 2011). The chronological progression of an innovation process with all of its change events and ruptures (and thereby indicators for the success or failure of these processes) can be the focus of research as well as the conditions and institutional circumstances, such as rules and practices that have an impact on the production of innovations. The role of organizations in such a process as well as the actors, with their practices and networks, can be focal points for ethnographic studies. Many innovations, particularly technical and scientific innovations, span long periods as complicated and dynamic processes. Thus innovation ethnographies that intend to research such innovations in real time often require a large (time) investment on the part of the ethnographer. This problem is further intensified by the retrospective inter-

¹ The mixed method approach can also include approaches that are exclusively qualitative or quantitative.

pretation of an artifact as an innovation because the ethnographer cannot foresee when, where, or how an innovation will arise.

The present paper addresses the question of how such innovation processes, with all their change events and ruptures, can be recorded and understood in their totality. Therefore, an ethnographic, but in the presented case strongly interview-focused approach is proposed. Unlike longitudinal ethnographies in which the ethnographer spends long periods of time in the field (Barley 1990), or multi-sited ethnographies (Marcus 1995) that follow an artifact through space and time, the ethnographic panels² provide brief, repeated field visits over a long period, thereby reducing the amount of time spent in the field. Additionally, during field visits, apart from participant observations, the ethnographer focuses on qualitative interviews. Thereby, the ratio of observation to interviewing can shift to interviewing becoming the primary data-collection method. By this methodological shift, the method presented can also be productive for processes that have already been partly or fully completed, i.e., when ex-post interpretation had already been done. At the same time, the method also allows the innovation process to be, partly ex-post, researched precisely without accompanying the innovation process totally in-the-making.

In this paper, the concept of innovation underlying this study will be discussed first. Subsequently, the ethnographic approach is described in detail and afterwards illustrated by an illustrative example. This example was largely undertaken ex-post, which means that part of the innovation process had already been concluded and could no longer be investigated concomitantly. Finally this paper will summarize the benefits of the method presented, in particular the embedding of interviews within participant observations.

2. Structural Innovation

There are numerous conceptions of innovation that are controversially debated. The present paper claims neither to provide an overview of the existing concepts of innovation nor to discuss various ideas of innovation. It will instead draw on Besio and Schmidt's (2012; see also Besio und Jungmann 2015) concept of structural innovation because innovation, as they see it, is a specifically interpreted process. In doing so, the focus of this concept lays on the interpretative construction in the field, which, as a long-term process, is a precondition for the sociological, ex-post interpretation of the process as an innovation:

Structural innovation understands innovations as a process that includes a variation, its selection, and finally its restabilization within the structures of a

² Here, the panel concept is based on a repeated study of an object at intervals but not on the same group of people as is usually the case with quantitative longitudinal studies.

reference system (Besio and Schmidt 2012). This is usually a complex and protracted process during which the actors in the field are confronted with a three-fold interpretation and observation problem (see Balogun and Johnson 2005) and must observe and interpret innovations as semantically observable structural-change processes that (1) fulfill the criteria for the artifactual variation, (2) which is selected as positively relevant, (3) and proves to be positively consequential for the reference system (Besio and Schmidt 2012). Multiple distinct reference systems can also play a role in observing as well as in interpreting the innovation, which is why the researcher must clarify to which reference system the observations and interpretations refer. This definition of structural innovation will be explained in detail in the following.

Within the concept of structural innovation, multiple approaches of innovation research are linked to Niklas Luhmann's social theory. Their approach, grounded in systems theory, is based on Braun-Thürmann's conception of innovation, which defines innovations as "material and symbolic artifacts that observers perceive as novel and experience as improvements over what already exists" (Braun-Thürmann 2005, 6, own translation). By that definition, on the one hand, innovations as artifacts are artificial and therefore do not appear randomly. On the other hand, they are also not simply produced by an ingenious person, but furthermore need one or more observers. The observer(s) must perceive "something" as both novel and an improvement.

The concept of structural innovation is not only based on economic-technical phenomena, but is tied to broader concepts of social innovations that can also be applied to other areas of society and thereby enabling practices, routines, procedures, or institutions to be defined as innovations as well (e.g., Braun-Thürmann 2005; Rammert 2010). With reference to evolutionary-theoretical models of technical innovation (including Dosi 1983; Schumpeter 1961; Tushman and Rosenkopf 1992; Geels 2004), Besio and Schmidt (2012) regard innovations as characterized by variation, selection, and restabilization processes (ibid., 4). As such, innovations avoid the guiding interventions of individual actors (ibid.). However, because innovations are desirable as a phenomenon of the modernity, Besio and Schmidt, in connection with research on national innovation systems (e.g., Freeman 1995; Blättel-Mink and Ebner 2009), assume at the same time that there is always an attempt to actively produce innovations (Besio and Schmidt 2012, 4f).

Linking these approaches, Besio and Schmidt (2012) understand

Innovation as a process [...] that is specifically marked by various observers, which can be found in a wide range of social contexts, that evolutionarily avoids the guiding interventions of individual actors and nonetheless is accompanied by attempts at control (ibid., 5, own translation).

The authors locate this concept in systems theory. Here, they particularly refer to the idea of a functionally differentiated modern society (Luhmann 1984, 1985, 1997, 2012) and according to René John (2005) to the concept of social

evolution (Luhmann 1997, 2012). Above all, the distinction that systems theory makes between semantics and structure is important for determining a structural innovation, which is why Besio and Schmidt (2012) understand innovation as a “duality”: “On one hand, it is part of the society’s semantic repertoire and, on the other hand, it is an outcome of specific evolutionary processes and structural changes in a social system” (ibid., 2, own translation). According to Luhmann, semantics can be described as a form of generalized meaning (1980, 19), particularly of a “meaning worth preserving,” which gives shape to the description of the self and others. Structures, in contrast, can be described as forms “that make the connection to various communications more apparent as operations of social systems” (see Besio and Schmidt 2012, 7, own translation).

Innovation, in the sense of a modern semantics, is a particular form of observation (ibid., 8), according to which, following Braun-Thürmann’s (2005) previously mentioned conception, an innovation is semantically present when one or more observers perceive something as novel and an improvement that they do not regard as spontaneously or randomly occurring and so consequently ascribe it to an author who, in their view, produced it to some extent deliberately (Besio and Schmidt 2012, 13). Because of the systems-theoretical embedment of their concept into the functionally differentiated society (Luhmann 1997, 437; see also Luhmann 1984, 1985, 2012), in the context of structural innovation, it is also possible to refer the as positive regarded change to a specific social system or subsystem, a so-called reference system (Besio and Schmidt 2012, 7). With respect to science, various reference systems are possible. The scientific community, organizations, work groups, or projects could, for example, represent such reference systems. An innovation is therefore an artifact that is ascribed to a creator’s action, and is also represented through innovation semantics as positively significant and momentous for a specific social context (ibid., 8).

Functionally differentiated societies are structurally characterized with modern semantics by accelerated social change which, according to Luhmann, can be described as evolution (Luhmann 1997, 456ff, 2012). Whereat, social change means evolutionary adjustment of social structures at various levels (Besio and Schmidt 2012, 10). According to Besio and Schmidt, sections of that change can now be described as innovations at a structural level (ibid., 10). Structural innovations are consequently characterized by processes of structural change, whereby innovative processes only occur “when structural change is happening as well as specific observations of that change based on the innovation semantic described” (ibid., 11, own translation). There are therefore two relevant reference systems – one of interpretation and another of structural change. These two are closely linked with one another.³

³ The reference system of observation and interpretation as well as the one in which the structural change happens can be (but are not necessarily) identical. Additionally, the reference systems can change in the course of the process. It is therefore always necessary to

Such an innovation process is accordingly analyzed with the three mechanisms which Luhmann used to describe as evolutionary processes: variation, selection, and restabilization (ibid., 6; Luhmann 1997, 413-505). In variation, a divergent, artificial, one-time event occurs which is not ascribed to a single actor. In the case of an innovation, it additionally must be associated with a positive future benefit (Besio and Schmidt 2012, 11f). A structural selection of the event occurs if the variation is used, confirmed, and condensed, i.e., if it can be applied within a reference system (ibid., 13). On one hand, the structures of a specific system, such as its interests and values are decisive for the selection of the variation. On the other hand, “the affiliation of the divergent artifact with desirable futures that are embedded into a system’s structures and strongly influenced by culture and semantics” (ibid., 15, own translation) are typical of this phase of selection. During restabilization, the variation that has now been selected is permanently integrated into the structure of a specific system. In the process, the changes due to the innovation in the system must be interpreted as positive and momentous. Here it must be noted that ruptures are possible in each phase of the process: A variation is not automatically selected and a selected divergence will not necessarily be integrated into the structures of the reference system.

3. Ethnographic Panels

An innovation is only a structural innovation if it is artifactual and its selection brings about a long-term structural change that is also positively semantically connoted by a specific group of people in a particular social context.⁴ The innovation process thereby includes the three stages of variation, selection, and restabilization and is usually a long-term process. Such an innovation process may exhibit several ruptures because a variation needs not necessarily be selected and if it is selected, long-term structural changes may not be established under certain circumstances. There are also always decisions that influence the progress of such processes and lead to the pursuit of one idea at the expense of another. Moreover, using the present definition, a positively perceived improvement due to a structural change can only be characterized ex-post as an innovation (see Bormann et al. 2011, 14). Before explaining the ethnographic panels proposed for researching such innovation processes, I will briefly discuss the advantages and disadvantages of ethnographies, particularly of real-time ethnographies (Hoholm and Araujo 2011) and longitudinal ethnographies (Barley 1990), for which the ethnographer spends long periods of time in the field, and further of pure (qualitative) interview studies, which are mainly realized ex-post.

explain to which reference system the sociological observations refer. In the following example, these two reference systems are mostly the same yet partly different.

⁴ Variation and selection are both one-time events.

The ethnography method enables the researcher to accompany such a process, including its ruptures, such as: critical moments, decisions, planned alternatives, and dead ends in-the-making (for more on the benefits of a real-time ethnography for the investigation of innovations, see Hoholm and Araujo 2011). Through ethnographic studies, implicit knowledge about practices and routines in participant observations can be understood firsthand. Given that the existence of an innovation can only be determined ex-post, the ethnographer runs the risk of realizing only after long-term observation that the observed process did not lead to an innovation. This is less problematic in the case of research questions that also or particularly focus on changing events and ruptures within innovative processes and (supporting or inhibiting) conditions for their arising. An ethnography of innovation is therefore especially appropriate when the process accompanying aspects of innovations, like ruptures, are (also) in the focus of a planned research.

Nonetheless, there are a few problems facing ethnographic observation of an innovation process: Many innovation processes are complex and protracted. For that reason, they are not limited to a particular place or group of people, meaning that they are not localized in time and space. Innovative product development, for example, can therefore involve multiple systems (e.g., laboratories or various markets as part of these systems) and various actors (e.g., researchers, managers, vendors). The process is thereby distributed among multiple locations and the circle of people involved increases as well (for more on multi-sited ethnography, see Marcus 1995). Thus, the ethnographer must gain access to multiple fields and acquire specific competencies and insights for the particular contexts. Furthermore, it also creates the irresolvable situation that the fieldworker cannot be in multiple locations at the same time and consequently cannot exhaustively follow up on parallel decisions. Additionally, accompanying an innovation process from variation to restabilization requires long-term participant observations in the field. To summarize, ethnographies of innovations, particularly real-time ethnographies, are consequently very elaborate and resource-intensive processes.

Interviews, by contrast, allow unobservables such as people's interpretations, considerations, and thoughts about situations and decisions to be queried. Conditions that elude the concrete situation because they do not appear explicitly, although they may be relevant for the particular situations or decisions (such as lack of materials or rules and prohibitions that restrict or enable the actors to take action), can be addressed in interviews. However, the potential of interviews is limited by the fact that they can only interrogate the knowledge that actors are aware of and have cognitive access to. Aspects that actors are not aware of (anymore) or that they do not consider relevant cannot be interrogated (anymore). Because of this, the researcher is confronted with the problem that actors do not recall many details and changes in the process or regard them as unimportant.

Often there is also a kind of collective or normative memory that influences recollections and makes outcomes appear as a single and, moreover, linear story.⁵ It is therefore precisely the dead ends and ruptures which are particularly difficult or impossible to investigate in (ex-post conducted) interview studies. Furthermore, the identification of the people who are relevant to the innovation process, and thus the relevant interview partners, also becomes the more difficult as the process becomes more complex and expands into multiple systems and various actors. In that case it is possible that actors in some areas may have little or no knowledge about the processes in other areas. That makes the reconstruction of the process more difficult for researchers, not only because it becomes more difficult to identify all the relevant people and areas, but also because the researcher must generate stronger links between the various pieces of information about the particular outcomes and their backgrounds.

The presented ethnographic method is an attempt to take advantage of the benefits of these two research methods for innovation processes. It therefore proposes multiple short-term field visits (which are significantly shorter than the data-collection period) to be undertaken throughout the whole process. During these field visits participant observations are reduced while focusing on and intensifying conversations and interviews. Various specific characteristics arise for the ethnography proposed here:

1. *Multiple short-term field visits rather than one long-term field visit:* Instead of one continuous field visit over a long period of time, which is often difficult or impossible to carry out due to the great expense or other disruptive conditions,⁶ I propose conducting field visits that are deliberately shorter, as opposed to long-term ethnographies (Barley 1990). These visits are conducted at regular or irregular intervals. Regularity has the advantage of being predictable for both the ethnographer as well as the people being accompanied.⁷ Irregular intervals can be better adjusted to events in the field which may be of interest to the ethnographer. The time between field visits can thereby be longer than the time spent in the field during a visit. For example, field visits can amount to a few days and be repeated at intervals of a few weeks. The ratio of field visits to periods without field visits, however, should be adapted, on one hand, to developments and events in the field. For processes in which the density of events is quite high and many decisions and developments are occurring in a short period of time, a shorter interval between field visits should be chosen. The density of events is likely to

⁵ This retrospection problem also frequently pertains to interview-based studies that only focus on parts of the innovation process. An alternative solution, which relies on structured self-observation of participants, is suggested by Roth (2015, in this HSR Special Issue) to investigate network dynamics in the early phases of innovation.

⁶ These include, for example, other tasks and obligations that the ethnographer has to fulfill.

⁷ This particularly applies when preparations must be made in the field, be it ensuring the availability of an office or desk, obtaining access to specific locations, or arranging meetings with certain people.

differ during the process, particularly between the three stages. Therefore, the ratio of field visits to periods without field visits may be varied in order to keep up with events in the field and in the ongoing observation process, and be adapted to the current density of events in every phase of the process. It can be assumed that a shorter interval between field visits should be chosen during the variation stage and possibly during the selection stage as well; whereas, longer intervals will probably suffice during the protracted restabilization stage. On the other hand, the intervals between field visits should be selected in a way that field visits become an everyday occurrence for both the observer and the observed: The ethnographer should still be able to remember events in the field. For the accompanied people, by contrast, the ethnographer's absence should not lead to alienation that requires the participants to readapt to his or her presence during the following field visits.

2. *Gathering routines and practices in the context of participant observation*: Within the framework of field visits, participant observation allows the ethnographer to learn about actors' work and interactions in the field from a firsthand perspective – as is the case for traditional ethnography (Emerson 1987, Fetterman 1997). Along with communicable subjects, uncommunicable subjects, like information that is difficult or impossible to communicate verbally as well as implicit knowledge that the actors in the field are not aware of, can be gathered this way (see Hirschauer 2001, 2006). Apart from everyday practices and routines, rules and behavior patterns, in general, as well as specific situations, can also be observed. This also applies for the decisions and actions embedded in them which constitute and guide the actors' work as well as create or limit options and further lead to variations, their selection, and ultimately to long-term structural changes. Participant observations can thereby follow different ethnographic approaches depending on the research question and methodological position: Open, exploratory approaches such as life-world analytical ethnographies (see Honer 1993, 2004) are as well suited as more closed, inductive approaches like focused ethnographies (see Knoblauch 2001, 2002, 2005).⁸

3. *Interviews to capture unobservables and to fill in the knowledge gaps produced by absences from the field*: Although brief and repeated field visits reduce the expenditure for the ethnographer,⁹ periods of absence nonetheless also create gaps in knowledge with respect to the interesting process. In order

⁸ An open, exploratory approach in the style of Honer (1993) was selected, for instance, for the example presented in the next section because I did not yet have a precise line of questioning. It was only later (when the topic became relevant in the field and I realized that it could be an innovation) that I shifted to a focused ethnography (Knoblauch 2005) for detailed research into the proposed process.

⁹ This reduces not only the amount of time spent in the field but also the amount of data. Due to a lack of focus (which can easily develop given that the relevant factors only become clear later in the process), such a large amount of data can accrue near the end of an innovation ethnography that the actually interesting process can hardly be managed or analyzed.

to close these gaps, focus during field visits is turned more intensely toward informal conversations and formal, oral interviews such as ethnographic interviews (e.g., Heyl 2001), in-depth interviews (e.g., Minichiello et al. 2008), go-alongs (Kusenbach 2003), or expert, guided, or open interviews (for more on qualitative interviews and interview research, see also Brinkmann and Steinar 2014 or Gubrium et al. 2012; Gubrium and Holstein 2001). These should make it possible to capture also the unobserved periods in the process. Within the framework of the ethnography proposed here, the ratio of the observations, in which practices and routines are in the main interest, are reduced in favor of all situations in which the ethnographer can enter into a dialog with the actors in the field. Such interview and conversation situations with the actors can be created in everyday situations such as: lunches, coffee breaks, incidental hallway meetings, or during work, provided that these situations are suitable for conversations. During field visits, opportunities for conversations about the past, current, and planned processes therefore present themselves in various situations. These numerous interviews and conversations during field visits make it possible for the ethnographer to learn from the perspective of the relevant actors about the time when he or she was not in the field. Although these descriptions are retrospective, provided that the intervals between two field visits are not too long,¹⁰ the probability of information loss due to actors' failure to remember past events detailed is not very likely. This allows the ethnographer not only to close the gaps in knowledge that arise due to his or her (more or less voluntary) absence when it is not possible for him or her to realize long-term participant observations. It also allows the ethnographer to fill the gaps that may arise due to the fact that the process is not localized at a single site and various process-related events occur at different locations at the same time or that the ethnographer is not granted access to certain situations or sites.

4. *More specific questions by embedding formal and informal conversations in participant observations:* Due to the ethnographer's knowledge based on field visits and the insights acquired there, it is also possible for the ethnographer to ask the actors more specific questions about past and current events, decisions, and options as well as about the planned process than would be in the case of oral, i.e., narrative, open or guided, interviews (see Heyl 2001). Given that purely interview-based studies cannot draw on extensive context knowledge as it is the case in ethnographic studies, the interviewer's perception of the situation in the field, i.e., of the routines, practices, and consequently the conditions under which the innovation occurs, remains thus abstract to some extent. An interviewer must therefore derive his or her questions from assumptions and information culled from written and oral discourses about the re-

¹⁰ The intervals would be too long if the accompanied and interviewed people could no longer remember events well due to too a high density of events or too long intervals between two field visits.

searched process. But if the interviews are embedded in – even short – ethnographies, then a much more detailed, process-accompanying interviewing and researching of the whole innovation process is possible through the gained extensive knowledge of the context.

5. *Time for reflection and analysis during periods of absence from the field:* Repeated field visits offer the ethnographer space for reflection during time outside of the field. Breaks give the ethnographer distance,¹¹ creating an opportunity to reflect on what he or she learned in the field, to talk with colleagues, and to analyze the collected data. These reflections and initial analysis of events in the field produce new questions and (first) hypotheses. In subsequent field visits, it then becomes possible to resolve open questions and test hypotheses. It is also possible to ask for explanations for individual, complex events and issues repeatedly until the ethnographer has understood them to a satisfactory extent. This represents a significant difference from studies that use interviews as their only method of data collection because it is usually possible to interview a person only once. For questions that arise later, it is often impossible to interview a person repeatedly. New questions or gaps in interview studies therefore normally remain unclear and if they are to be resolved this can only be realized through further interviews with other informants, provided that there are other relevant people who not have been interviewed already. This is usually not the case, because particularly in complex contexts in which various people have participated in different parts of the innovation process, concrete actions and events often happen exclusively in small groups of a few people.

6. *By contrasting earlier and later observations and information, shifts in the innovation process become apparent:* Another advantage that arises through brief, repeated field visits is the possibility of observing shifts in the research process: When does something run differently from the way it was planned during the previous field visits? Or how do the actors' perspectives change as a consequence of certain events? Is an action legitimized retrospectively in a way that deviates from its original idea? These shifts can be understood by contrasting observations during different field visits as well as by comparing them with subsequent or previous narratives about events, decisions, and actions.

To summarize, ethnographic panels within the framework of short ethnographies enable the observation of the normal work day with its general routines and practices, specific situations, decisions, and actions. By focusing on interviews and conversations with actors in the field, the gained information can fill in the gaps that arose during the time when no field visits were realized or during which

¹¹ Breaks, where applicable, prevent the ethnographer from becoming overly absorbed in the field, i.e., going native, causing him or her to become too familiar with the field and its processes to become too natural, which can result in a loss of ability to perceive and interrogate from an outside perspective. The issue of proximity to the field is quite contentiously debated and quite positively valued (Kanuha 2000; Hegner 2013).

the ethnographer was elsewhere in the field. This allows the ethnographer in a certain way to create a “thick description” (see Geertz 1973) of the research process. In my opinion, it is therefore possible to ethnographically accompany even very protracted and complex innovation processes that span years with relatively little information loss and to capture comprehensively their relevant decisions, difficulties, controversies, change events, and dead ends.

Ethnographic panels are therefore suited to comprehend protracted processes and to research questions that focus on process accompanying aspects of innovations – without requiring long-term participant observations. Moreover, this approach makes it possible for researchers to accompany also processes that are not localized in terms of space or time. Another benefit of this methodology is that the research into innovation processes need not be pursued from the onset but can start during a later stage of the innovation process, for example, after or during the selection process. Field visits and participant observations also give the researcher a better understanding of previous, non-observed stages than would be possible in pure ex-post research designs without any observations of the process because his or her own observations allows the researcher to recognize and comprehend latent structures that the actors do not perceive or fail to acknowledge, such as non-reflective routines and practices (see “*Blinder Fleck*” in Luhmann 1984, 1985).

In the following, the ethnographic panel approach will be illustrated by an example of a long-term innovation process in which the participant observation begun after the phase of selection was concluded.

4. The Realization of a New Physical Phenomenon and its Applications

4.1 Embedding the Example Case: Method Design and Case Description

The example presented here refers to research on an innovation process that was carried out as part of a larger ethnographic study. During this larger study, by chance I observed in one group a research process that match the concept of structural innovation underlying this paper. The following remarks therefore only refer to the ethnographies that were pursued in this group over a period of approximately two years. During the first year and a half, I made weeklong field visits in one-month intervals. During the following six months of this study, I reduced the number and duration of the visits by about half. I conducted ethnographic and semi-structured interviews with individual researchers during my entire time in the field. I accompanied the researchers throughout their everyday work: from office and laboratory work to breaks, meetings, and

other formal and informal gatherings. Additionally, I undertook document analyses as well as literature and internet research.

When I began observing this team¹² and its project, a few important experiments were already finished. Although the initial idea for the project arose three years earlier, they had not yet completed the project and further experiments, which I followed during my field visits through participant observations, interviews, and informal conversations, which were carried out over the year and a half that followed. Therefore, I did not accompany the process described from the start. The following descriptions should show how an understanding and tracing of the entire innovation process with its important decision-making processes and dead ends could nonetheless be comprehended by participant observations, interviews and conversations generating insights into the group's practices, structures, and actors.¹³ The process described treats the discovery of a new physical principle on the basis of which two technical applications were developed. Because of multiple relevant reference systems, it must be clarified repeatedly, with respect to the phases of the innovation process, to which reference system the statements refer.

4.2 Variation: An Idea Arises

The starting point for the innovation process outlined here can be traced back to the idea from two postdocs, which arose three years before the start of my study. Due to a new experimental setup, a new – and previously unproven or at least so far experimentally unmeasurable – phenomenon should be measurable. By avoiding a well-known physical phenomenon, the new experimental approach should allow measuring the unproven phenomenon. The apparatus and measuring equipment needed, as well as the necessary materials, were available in the work group. Thus, the material conditions existed and the experiment could be executed.

This information emerged from conversations – particularly during shared lunches or in the laboratory – with a doctoral candidate of the team. The origin of the project idea had briefly come up in conversation right at the beginning of my field research. However, given that the innovation process was not yet the focus of my research interests, I had not pursued the subject further at this point of my

¹² When I began my observations, the team consisted of two doctoral candidates, one who had already completed his dissertation and another one who was new to the group and was just starting her dissertation. However, other people had previously participated in the project.

¹³ It should also be noted that the outcomes of the innovation process presented here were not the focus of the broader, more extensive research project. They are instead an incidental result. Hence, the research on the innovation process could have been more detailed and focused than was actually the case. In my view, the fact that it was possible to investigate the process despite these circumstances only highlights the possibilities that the method proposed offers for innovation research.

study. This happened later on, when I recognized the innovation process at an advanced stage. When I then analyzed my data with regard to the innovation process it became clear to me that the aspect of the genesis of the idea had been left underexposed. During my subsequent field visits, I was able to quickly and easily resolve the open questions and integrate the new information into my existing knowledge about the innovation process. Both postdocs had left the work group long before my arrival, which is why the information about the genesis of the idea is not firsthand information and why I could not clarify it in detail.¹⁴

4.3 Selection and Restabilization within the Group

Because both postdocs had relative autonomy of action and not all research decisions had to be coordinated with the group leader, they were able to start taking measurements independently.¹⁵ Therefore, they planned a corresponding experiment and initially took a few simple measurements. These “quick and dirty” measurements showed that the experiment worked in principle but that the planned measurement was not so technically simple. It then became clear that it was a more complex project. They discussed their ideas and experiments in meetings with the group leader, who supported their further pursuit of the idea and agreed to initiate a corresponding doctoral project. Thus, the idea had selectively turned into a project that was considered worth to pursue within the reference system¹⁶ *work group*. Furthermore, its execution was regarded as not only positive in the sense of attaining a doctoral degree but also as potentially very interesting and promising from a physicist’s perspective. All theoretical criteria for a selection are therefore fulfilled.

For the start of the project, however, another process was decisive – the doctoral candidates’ choice of topic: In general, at the beginning of their time in the group, the new doctoral candidates were able to participate on various experiments. In doing so, they became somehow familiar with these topics. After a few months, they ultimately had to make a choice and decide on one of the projects. During this phase, the postdocs of the group were supervising and supporting them on their decision-making process. The project presented here was chosen as a dissertation proposal by a doctoral candidate. He made this decision during meeting with a postdoc, who was one of the two who came up

¹⁴ Ethnographic access makes contact with such key people easier to establish for the purpose of executing retrospective inquiries: that is how I was able to establish contact with one of the two postdocs who I had met during my first field visit. Nonetheless, I have not pursued this aspect further.

¹⁵ By the time I began my field visits, the structures of the group had changed so that the researchers’ autonomy was more limited at this moment. A process, as in the present case, probably would not have been possible later on due to the changed conditions, because the autonomy at that time had played an important role for the project start.

¹⁶ As part of a research institution, it is a subsystem of that organization.

with the idea in the first place. Henceforth, the PhD student and the postdoc worked on the aforementioned experiment as a team. Due to the choice by the doctoral candidate, a selection within the working group occurred and the idea led to a concrete doctoral project that was worked on during the following years. The work group's choice of topic is the actual selection in this reference system; the choice by the doctoral candidates is a consequence of this selection and part of the restabilization process.

At this stage a possible dead end to an innovation process within the group becomes apparent because projects can also not be selected and are then not pursued further (at least at this point): During this period, there were more possible project ideas than new doctoral candidates. The projects that were not selected were "deferred." This means they were left on a virtual list in the group's discourse of possible topics that could be worked on by other doctoral candidates at a later date. One of the available topics was in fact selected by a doctoral candidate two and a half years later (albeit in modified form).¹⁷ The selection or non-selection of a topic by a doctoral candidate therefore influenced the pursuit of ideas, or at least its timeframe. In the context of the study presented here, there is little to say about which ideas, in addition to conversant ones, were available for selection at this time, because if an idea was already forgotten, nothing more could be said about it in the field. Also, there is no statement possible about the further pursuit of the non-selected ideas later on, because not yet realized ideas could be implemented in the future or not. As no interviews or observations were executed during that period, the reconstruction of the events is highly dependent on the memory of the actors in the field – as is the case for all ex-post methods.

The doctoral candidate, together with the postdoc, then started with the project. They modified the setup during the first year of the project and this way created a measurement setup that finally made it possible to verify the new physical principle. This discovery was regarded as very positive within the group: Discoveries in physics generally have a positive connotation. It was assumed that the outcomes could be published in a prestigious scientific journal. Also, the group saw various opportunities to apply this phenomenon in a way that could be advantageous for their experiments. Thereby, within the reference system *work group*, the execution of their project as well as the planned publication, are restabilizations of the selected variation which is regarded as positive.

This information was also collected retrospectively and predominantly through informal conversations. Indeed, the topic selection and the content of the doctoral projects were discussed in several interviews with the PhD students, which were conducted as part of the more comprehensive ethnography before recognizing the innovation process described. Nevertheless, the alterna-

¹⁷ This change in the project idea came about based on the results of the innovation project presented in this paper.

tive topics were not mentioned in these interviews at all and the conversation between the PhD student and the postdoc, because of which the PhD candidate has chosen the presented project, came up only superficially. From the perspective of the physicists, it seemed that these details of the selection process had no relevance for the course of their projects. These aspects only became ascertainable by my exploration of the innovation process and the many theme related conversations during the recurring field visits. In the process, it was helpful that I did not need to make conversation appointments for smaller requests or questions because of the regular contact in the field. Instead, conversations simply occurred. Because of my regular field visits my stays in the group became somehow ordinary and mundane. Sometimes it was even unclear to many scientists whether I had just arrived, had been there for a while, or simply had not left the field at all. My work and I had become, to a certain extent, part of their work group – and, as it was common among the researchers in the group, I was thus able to knock on open doors at any time to ask quick questions. At the same time, I was familiar with many of the group's practices, such as workflows, group structures, and the various experiments and people, allowing me to constantly integrate new information into a broader context.

4.4 Two Additional Innovations and the Innovation Process in Relation to other Reference Systems

For the next step, the team – partly in conversation with the group leader about the course of the project – developed two ideas for applying the physical principle discovered before. The ideas again are two variations within the reference system *work group*. In both cases, the applications were considered as essentially feasible and promising. Moreover, the necessary equipment and human resources were available within the group. This constituted a selection of both variations within the reference system *work group*. However, because the second application idea required a particular tool with a different and time-intensive setup that a different team of the work group had already taken on, they initially decided to carry out the first application idea. That meant the restabilization of the first variation within the work group, since the second was not pursued further at this point. The preference for the first application idea as against to the second one was based on the criterion of a simpler and faster implementation. If the second idea is not resumed again at a later date, this would mean a dead end within the innovation process in the phase of restabilization for this second selected variation.

Thus, during the following year, the team successfully developed a new measuring apparatus, a first application of the new physical principle. This application was a cheaper and experimentally simpler solution with respect to another, common tool. Additionally, the new physical principle and its application were published in a very prestigious interdisciplinary scientific journal.

The innovation was therefore not only relevant for the work group but also for the entire discipline and, moreover, for other scientific fields as well. While the proposal of publication and its execution within the work group is another part of the restabilization phase within the reference system *work group*, the journal's acceptance for publication represents a selection and its publication a restabilization within the reference system *science*.

Towards the end of the second year, the team of the two researchers, the PhD candidate and the postdoc, were able to use the other setup for the second application in which the necessary tool had been set up in the meantime. This meant that the team was now able to start with their experiments and to carry out the second application idea. Consequently, there was also a restabilization of the second selected variation. Due to the now implemented tool, they did not need to change the setup for this experiment anymore. They were able to implement the second idea quite quickly: Like in the other case, the team developed an alternative apparatus with financial and experimental advantages over a known measuring method. Furthermore, they published their results again in a very well respected interdisciplinary, albeit thematically specialized, scientific journal. Like both previous outcomes, these results were not only relevant for the group but also for a broad scientific readership and can therefore likewise be described as a structural innovation for the reference system *work group* as well for the reference system *science*.

During this realization of the setup for the second application, I began participant observations in the group.¹⁸ The experiments on the other innovation processes described above, the new physical principle and its first application were pursued through further experiments during the period of my field visits. In the process, insights and understanding of the physical phenomenon and its applications were systematically expanded and completed through, for example, repetitions of the same experiments with different materials. This enabled me to observe these experiments and the team's practices from a firsthand perspective. Thereby I became aware of the innovation aspects and began reconstructing the research process presented here.¹⁹ I adapted my field visits to events in the field so that I was as much as possible at times in the field when the team was working in the laboratory.²⁰ But at the same time I was able to witness the work outside the lab. During my monthly repeating field visits of a few days I also spent a varying amount of time with observations of this team

¹⁸ The postdoc who had previously been undertaking the project with the male doctoral candidate had just left the group and the female doctoral candidate had already been participating in the experiments for a few months.

¹⁹ In doing so, the knowledge about the team and the work group I had gained through my participant observations as well as my increasing familiar contact with the people of the group was very helpful.

²⁰ This time in the laboratory usually amounted to a few weeks between which the team either carried out assessments on the computer or planned further experiments.

and its project which is presented in the paper. Because I was soon quite familiar with the routines and procedures of the experiments and the laboratories, I was able to assess when the relevant events occurred.²¹ Therefore the amount of participant observations could be reduced.

4.5 Possible Further Developments in the Future

In summary, during the three and a half years of the team's research, the new physical principle has been adopted as a positively relevant artifact in the form of two applications within the structures of the work group and in terms of publications as new knowledge in the discourse of the discipline and of the scientific system. The artifact has therefore been used, confirmed, and condensed in the restabilization process in more than one instant. The principle has been structurally adopted within the group's knowledge and will be applied in its subsequent research, for example in form of the other modified dissertation project by the new doctoral candidate mentioned above.²²

What remains open is whether the observed innovation will be relevant beyond the scientific system. According to the researchers, both applications could in principle be developed to marketable measuring apparatuses. Based on other scientific innovations, several spinoffs have developed from this group that have developed and commercialized these innovations. Hence, one of these companies would be able to take on the development of the apparatuses. In addition the group also has access to the necessary expertise to create a new startup. The doctoral candidate, who I interviewed regarding the possible marketability, considers this rather unlikely as the two new measuring apparatuses are only of interest to a few (scientific) groups.

The discourse within the group about the future application of the new physical principle is nonetheless very positive and even sees a new technology as a possible future vision. However, the equipment that this would require is currently very expensive, complicated and incredibly large, what would require big changes in the field of technology for turning the two new applications into a piece of technical equipment for everyday use.

²¹ The lab work consisted of many (routine) jobs, some of which were quite protracted and had to be repeated during various phases of the experiment (such as adjusting the equipment) without the possibility of gaining new insights during these processes.

²² I am referring to the project that was not chosen in the first instant, but two years in a modified way by new doctoral candidate. The modification of the original project idea is based on the new insights and measuring methods gained in the project described in this paper (see chapter 5.3).

5. Advantages of Ethnographic Panels for Innovation Research

The presented results are based on participant observations, during which I focused on conversations and interviews, and which I conducted as part of a larger ethnographic study. Embedding these interviews and conversations in an ethnography had various advantages. It enabled me to establish a specific contact within the field and to generate a broad context-knowledge of the field, including its structures, rules, actors, and practices. Therefore, I was able to include the information obtained from the interviews and conversations into this context knowledge of the field. During my participant observations of the group's everyday work, from the shared lunches among colleagues (during which, among other things, the laboratory work and its problems were discussed and debated) to (lab-)work and various group meetings (where outcomes were presented and discussed as was the future proceeding of the projects) I became acquainted and familiar with the group and its practices. As a result, beside the group's practices, I also got to know the group's hierarchies and decision making processes, not only by the interviews and conversations with the various actors from their point of view but also through the participant observations from a firsthand perspective. Specific events and, in particular, individual decisions can be analyzed with respect to the knowledge of this broader context. For example, individual perception and recognition of hierarchies, particularly in areas where they were not subject to much formal regulation or where discrepancies existed between formal and informal hierarchies, played a decisive role in (perceived) scope of action or rule breaking which ultimately may lead to new insights. Even when the interesting events are predominantly in the past, as in the present example, broader knowledge of the group's structures and practices provides an important background for research into and analysis of the innovation process.

Moreover, with one exception,²³ I got to know all individual actors involved in this project and their everyday work. This led to easier access to information because it created many different opportunities for conversations during my participant observation – allowing me to resolve open questions as shown above. Additionally, it also created very quickly a trusting relationship in which participants mentioned things that they probably would not have readily revealed to an unknown third party. Many of the actors in the field were quite receptive to and interested in my study and wanted to support my research.²⁴ Accordingly, the

²³ That person was one of the postdocs who had originated the initial idea and who left the group and the project before I started my research in this group.

²⁴ I suspect that this was because my study was for my dissertation and I was therefore in a similar situation to many of them, and because of the cooperative operating principles

actors in the field were very open with me in both, conversations as well as interviews. This certainly would not have been the case with requests from a stranger. After my initial requests about possible future interviews, for example, I was from then on addressed repeatedly by some scientists, reminding me that these are still pending and asking me when I would have time for them. Additionally, my broad context knowledge of the field made it not only easier for me to understand what the scientists were describing but it also made it easier for the people I was interviewing because they could refer to my field knowledge, like events and people who were familiar to me and they did not have to explain everything. Thus, it was possible for me to integrate the information I had obtained during conversations as well as interviews into this broader contextual knowledge of the field and to ask specific questions accordingly. I was therefore able to reach a depth of content in the interviews that would not have been possible otherwise. Subsequently I was able to ask follow-up questions with no difficulty when interviews raised new questions or when I noticed during my analysis that certain aspects were not yet clear enough for my study.

Furthermore, I accompanied within this work group not only the team and its project described above in form of participant observations, but also many other projects and their participants. These included, among others, both projects which had been available for the doctoral candidate from the described project, and which were chosen by other doctoral candidates. It would therefore be possible to compare the progressions of these three projects. Possible conditions for continuing or changing the course of the project and their causes as well as the success or failure of those projects could be analyzed that way.

The presented example has illustrated that it is possible to use ethnographic panels to understand even long-term innovation processes and to identify ruptures and dead ends – without accompanying the entire process in real-time through protracted field visits. Repeated, short-term participant observations and a focus on informal conversations and formal interviews make it possible to reconstruct even innovation processes that have occurred partly or entirely in the not too distant past. By the use of participant observations of current events, including, where necessary, ex-post conducted ones, structures, practices, and routines, besides communicable also uncommunicable subjects get ascertainable. Additionally, past and unobservable topics can be addressed in various kinds of conversations and interviews. Thus, embedding interviews and conversations in participant observations as proposed here allows the researcher to take advantage of the benefits of both methods for innovation research and to gain a broader understanding of the innovation process. But beyond this, as a pluralistic method, ethnography also offers the opportunity to embed various

within the group: Executing a project alone would be, from the actors' perspective, inconceivable. In many areas, they are dependent on the help of others – be it in the lab or in interpreting outcomes, everything is done in the team.

methods. Depending on the research question, in addition to qualitative interviews, it is also possible to bring in other methods that have not been used here, including, of course, quantitative ones. Such an approach could make the method usable for other kinds of innovation research questions and open up new perspectives for innovation research.

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